

RESEARCH REPORT NObsr-71006-1.

PROGRESS REPORT ON  
DEVELOPMENT OF INFRARED AND ULTRAVIOLET SOURCES

CONTRACT NUMBER NObsr-71006

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QUARTERLY DEVELOPMENT REPORT NObsr-71006-1

ON

DEVELOPMENT OF INFRARED AND ULTRAVIOLET RADIATION SOURCES

This report covers the period Aug. 1, 1955 to Sept. 30, 1955

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Navy Department, Bureau of Ships, Code 853  
Contract Number - - - NObsr-71006

### ABSTRACT

Experimental work was started on making small size cesium vapor lamps of 15 to 20 watts power rating. The light sources were mounted in sealed beam reflector type envelopes similar to those used for automobile headlamps. Five lamps were sent to the Underwater Sound Laboratory for their laboratory and field tests.

### PURPOSE

An engineering research program was undertaken in our laboratory upon invitation of the U.S. Navy, Bureau of Ships to "Study, investigate, design, develop and fabricate experimental special lamps suitable for use in infrared and ultraviolet communication sets". The work described below is a continuation and modification of development work carried out under former contracts - principally NObsr-57285.

### INTRODUCTION

Two days were spent at the Underwater Sound Laboratory and on Fischer's Island (March 30 and 31, 1955) to observe tests and demonstrations of our small cesium lamps, and to discuss the communications program with their project engineers as it affects infrared sources in this new development contract. At the invitation of Mr. C. S. Woodside a trip was made to the Bureau of Ships, Washington, D.C. on August 17, 1955 to attend a meeting on Infrared Communications with men from the Bureau of Ships, Underwater Sound Laboratory, Naval Research Laboratory, Signal Corps Laboratory and Northwestern University. These meetings furnished the basis for establishing a suitable cooperative program for our activities, and indicated the type of experimental work that should be done to yield the most useful information and greatest benefit to the various defense departments.

Our present program includes the making of low wattage sealed beam cesium vapor lamps especially those of less than 10 watts power consumption. Some thought and effort has been given to the construction of low wattage, low voltage tungsten filament lamps that might be used in a portable, audio modifiable light source. Further consideration will be given to larger size cesium lamps that provide 360° horizontal and 20° vertical beam spread. A 250 to 300 watt cesium lamp in a Fresnel lens housing having internal reflector baffles was suggested several years ago for this application, but no experimental work was done.

### EXPERIMENTAL WORK

Figure 1 shows a sketch of a small cesium vapor lamp mounted in an evacuated outer housing similar to a sealed beam automotive headlamp. In these lamps the clear glass lens is sealed to the reflector with a thermosetting plastic cement called Araldite AN100 instead of by the direct fusion of the glass parts. A nichrome wire heater is wound around

the arc tube at a distance of several millimeters to furnish the necessary resistance ballast to operate the lamp on about a 12 volt storage battery. The heat from the ballast raises the vapor pressure of the cesium metal and thus increases the efficiency and infrared output from the lamp. The three metal caps protruding out of the back of the lamp are soldered to flexible leads that terminate in a type P303-CCT Jones plug. The polarity of the Jones plug is as follows: -

#1 pin - Ballast lead  
#2 " - Cathode "  
#3 " - Anode "

This lamp structure is assigned a tentative nomenclature of "CL-4 type" to minimize the number of words to describe it. This is the same type of lamp that was made on Order Number NYOA-91438 dated Nov. 17, 1954 that called for 6 such lamps. These lamps were delivered to Underwater Sound Laboratory Jan. 19, 1955.

Four "CL-4" type lamps were made to meet the specifications of item 1-a. A fifth lamp, #5-S, actually drawn to scale in Fig. 1, has a shorter arc length and smaller diameter than the four lamps mentioned above. The horizontal beam spread from this lamp, while the arc tube is in a vertical position, is about  $10^\circ$  to half intensity and  $16^\circ$  to the 10% intensity points. The horizontal beam pattern of this lamp is shown in Fig. 2. The vertical beam spread should be about 50% larger than the horizontal beam. Table I gives data on the changes in relative beam intensity in arbitrary units (galvanometer deflections) with changes in current through lamp #5-S. Column A is current in amperes, B is arc voltage, C is voltage across both the lamp and ballast resistance, D is infrared beam intensity measured with a cesium photocell and Wratten #87 filter. These data were obtained with the lamp operating on d.c., lamp vertical, anode at bottom. A waiting interval of 2 to 3 minutes occurred between each of the successive current settings to allow for thermal equilibrium. Operating characteristics and field performance data have been obtained from the more or less standard size "CL-4" lamps, so only the data from the experimental lamp #5-S is recorded in this report.

Four standard size "CL-4" lamps and the experimental lamp designated as #5-S were shipped by express to the Underwater Sound Laboratory on September 29, 1955.

#### CONCLUSIONS

The data obtained from experimental lamp #5-S indicated that with changes in lamp structure one may make usable lamps with still lower wattage that the 15 to 20 watts consumed by the small sealed beam cesium vapor lamps that are identified as type "CL-4" in this report.

#### PROGRAM FOR NEXT INTERVAL

We expect to make a few more "CL-4" type lamps to meet the requirement of item 1-a in the contract, so that over a period of two years we will complete the request for 24 such lamps. Additional lamps of this general type will be made with changes in lamp size and structure and their characteristics measured.

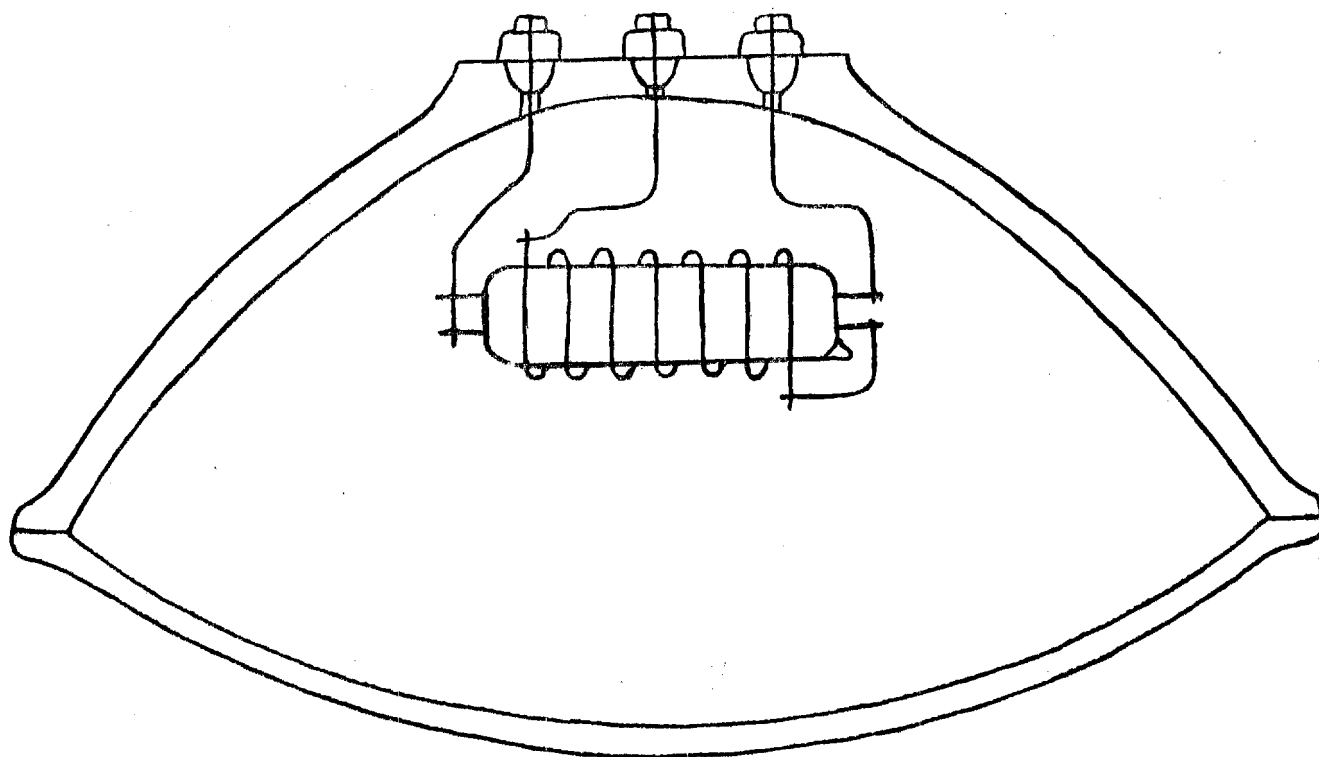
TABLE I - DATA FROM LAMP #5-S

<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
1.7 amp.	6.5 volts	12.2 volts	9.2 cm.
1.6	6.5	12.0	9.0
1.5	6.5	11.6	8.5
1.4	6.5	11.2	7.6
1.3	6.5	11.0	7.2
1.2	6.6	10.8	6.4
1.1	6.8	10.5	5.8
1.0	7.0	10.4	5.2
0.9	7.0	10.3	4.8
0.8	7.4	10.2	4.3
0.7	7.5	10.0	3.7
0.6	7.9	9.8	3.1
0.5	8.2	9.8	2.6

Engineering personnel involved in this contract and the time spent during this interval were: -

N. C. Beese	163 hours
J. N. Hoffa	210 "
A. Schramm	<u>22</u> "

Total 395 hours



SKETCH OF "CL-4" CESIUM VAPOR LAMP # 5-S

FIG 1.

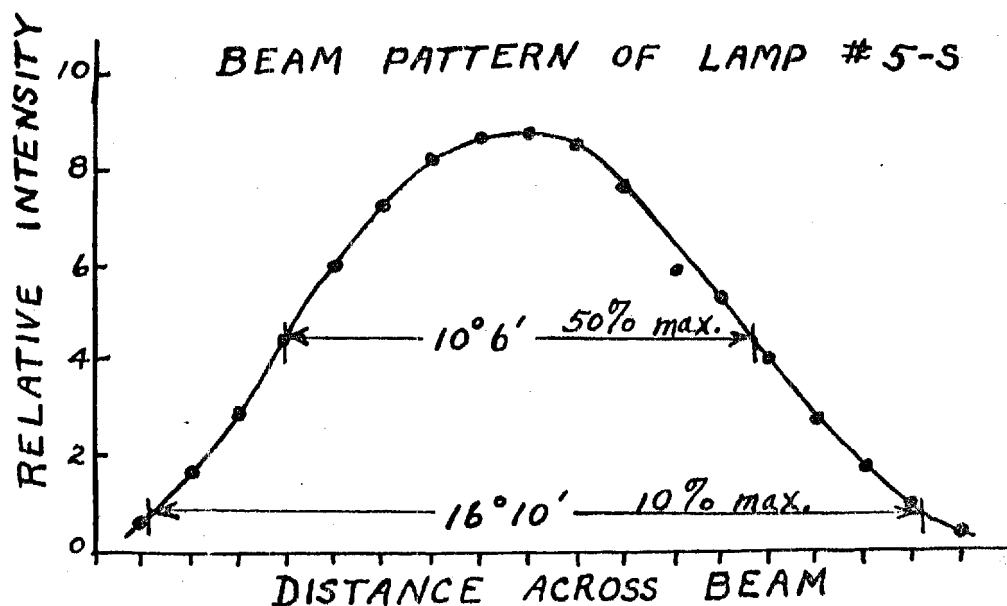


FIG 2.

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